SECTION 4: INDUSTRY PROFILE

4.1 INTRODUCTION

The construction sector is among the largest and most important sectors in the national economy. The construction industry is divided into three major subsectors: general building contractors, heavy construction contractors, and special trade contractors. General contractors build residential, industrial, commercial, and other buildings. Heavy construction contractors build sewers, roads, highways, bridges, and tunnels. Special trade contractors typically provide carpentry, painting, plumbing, and electrical services. Additional information. including detailed descriptions of industry size and revenues, can be found in the document "Economic Analysis for Final Action for Effluent Guidelines and Standards for the Construction and Development Category," EPA-821-B-04-002.

4.2 INDUSTRY PRACTICES AND TRENDS

4.2.1 OVERVIEW OF CONSTRUCTION LAND-DISTURBING ACTIVITIES

Constructing a building or facility involves a variety of activities, including the use of equipment that alters the site's environmental conditions. These changes include vegetation and top soil removal, regrading, and drainage pattern alteration. The following provides a brief description of typical land-disturbing activities at construction sites and the types of equipment employed.

Construction Site Preparation. Construction activities generally begin with the planning and engineering of the site and site preparation. During this stage, mobile offices, which are usually housed in trailers, are established on the construction site. The construction company uses these temporary structures to handle vital activities such as preparing and submitting applicable permits, hiring employees and subcontractors, and ensuring that proper environmental requirements are met. The entire construction yard is delineated with erosion and sediment controls installed and security measures established. The latter includes installing fences and signs to warn against trespassing and to mark dangerous areas. After the site is secured, equipment is brought to the site (and is stored there throughout the construction period).

Clearing, Excavating, and Grading. Construction on any size parcel of land almost always calls for a remodeling of the earth (Lynch and Hack,1984). Therefore, actual site construction begins with site clearing and grading. Organic material—in particular, roots—cannot support the weight of buildings and must be removed from the top layer of ground. (Some developers stockpile the organic material for use during the landscaping phase of construction rather than paying for it to be hauled from the site.) Construction contractors must ensure that earthwork activities meet local, state, and federal regulations for soil and erosion control, runoff, and other environmental controls. The size of the site, extent of water present, soil types, topography, and weather determine the kinds of equipment used in site clearing and grading (Peurifoy and Oberlender, 1989). Material that will not be used on the site must be hauled away by tractor-pulled wagons, dump trucks, or articulated trucks (Peurifoy and Oberlender, 1989).

Equipment used for lifting excavated and cleared materials include aerial-work platforms, forwarders, cranes, rough-terrain forklifts, and truck-mounted cranes. In addition, track loaders are used for digging and dumping earth (Caterpillar, 2000; Construction Equipment On-Line, 1996-1998; Lynch and Hack, 1984; and Peurifoy and Oberlender, 1989).

Excavation and grading are performed by several different types of machines. These tasks can also be done by hand, but this is generally more expensive (Lynch and Hack, 1984). When grading a site, builders typically ensure that new grades are as close to the original as possible, to avoid erosion and storm water runoff (Lynch and Hack, 1984). Proper grading also ensures a flat surface for development and drains water away from constructed buildings.

Excavation and grading equipment includes backhoes, bulldozers (including the versatile tracked bulldozer), loaders, directional drilling rigs, hydraulic excavators, motor graders, scrapers, skid-steer loaders, soil stabilizers, tool carriers, trenchers, wheel loaders, and pipeliners. Equipment selection depends on functions to be performed and specific site conditions (Caterpillar, 2000; Construction Equipment On-Line, 1996-1998; Lynch and Hack, 1984; and Peurifoy and Oberlender, 1989). Therefore, multiple types of equipment are used throughout the clearing and grading process.

Self-transporting trenching machines, wheel-type trenching machines, and ladder-type trenching machines are also used during site excavation. Self-transporting trenching machines are used to create shallow trenches, such as for underground wire and cables. This type of machine has a bulldozer blade attached to the front, is highly maneuverable, and can be used to dig narrow, shallow trenches. Wheel-type trenching machines also dig narrow trenches, most often for water mains and gas and oil pipelines. Ladder-type trenching machines are used to dig deep trenches, such as for sewer pipes. These machines might have a boom mounted at the rear. Along the boom are cutter teeth and buckets that are attached to chains. As the machine moves, it digs dirt and moves it to the sides of the newly formed trench (Peurifoy and Oberlender, 1989).

Power shovels can also be used for excavating soils. They are used on all classes of earth that have not been loosened. For solid rock, prior loosening is required. As materials are excavated, they are immediately loaded onto trucks or tractor-pulled wagons and hauled from the site (Peurifoy and Oberlender, 1989). Hydraulic excavators, with either a front or a back shovel, are also used to dig into the earth and to load a hauling vehicle. There are several categories of hydraulic excavators, including backhoes, back shovels, hoes, and pull shovels. Hydraulic excavators are one of the most widely used types of excavating equipment because of their ease of use and their ability to remove the earth that caves as it is moved. They are effective excavating machines, and they are easy to use in terms of loading some a hauling vehicle (Peurifoy and Oberlender, 1989).

Draglines, used to dig ditches or build levees, can transport soil within casting limits, thus eliminating the need for hauling equipment (Peurifoy and Oberlender, 1989). Draglines have a bucket that hangs from a cable. The bucket is brought through the dirt and toward the operator (Lynch and Hack, 1984). Draglines can be used on both wet and dry ground and can dig earth out of pits that contain water (Peurifoy and Oberlender, 1989). They are most useful for making large cuts and channels below the level of the machine as well as for making valleys, mounds, slopes, and banks (Lynch and Hack, 1984). Draglines have a lower output than power shovels, and do not excavate rock as well as power shovels (Peurifoy and Oberlender, 1989).

Draglines can be converted to clamshells by replacing the dragline bucket with a clamshell bucket. A clamshell is typically used for handling sand, gravel, crushed stone, sandy loam, and other loose materials; it is not efficient in handling compacted earth, clay, or other dense materials. A clamshell is lowered into a material, and the bucket closes on the material. It is then raised over a hauling vehicle and the materials are deposited (Peurifoy and Oberlender, 1989).

Scrapers, either self-powered or drawn by tractors, dig and compact materials by taking up earth from its underside with toothed scoops and loading it into hauling vehicles. Scrapers are useful in removing earth and weak or broken rock, and for excavating hills and rock faces. Some scrapers are designed for long hauls; others with good traction are used on steep slopes (Lynch and Hack, 1984).

A crawler tractor, which pulls a rubber-tired self-loading scraper, is often used for short-haul distances. The crawler tractor uses a drawbar pull to load the scraper. It has good traction and can operate on muddy roads. It is, however, a slower vehicle and thus is more appropriate for shorter hauls.

Wheel-type tractor-pulled scrapers, which come in two- and four-wheel tractors, are used for longer hauling distances. Unlike the crawler tractor-pulled scrapers, the wheel-type tractor-pulled scrapers do not maintain good traction. Under such conditions, a helper tractor, such as a bulldozer, might be used (Peurifoy and Oberlender, 1989).

All of these machines shape and compact the earth, a crucial site preparation step. In addition, earthwork activities might require that fill be brought in. In such cases, the fill must be spread in uniform, thick layers and compacted to a specified density with an optimum moisture content. Graders and bulldozers are the most common earth-spreading machines. Machines that compact include tractor-pulled sheep's foot rollers, smooth-wheel rollers, pneumatic rollers, and vibrating rollers, among other equipment (Peurifoy and Oberlender, 1989). Rollers and scarifiers are used either to compact or to break up the ground (Lynch and Hack, 1984).

To remove rock, it must first be loosened and broken up–usually through drilling or blasting. Drilling equipment includes jackhammers, wagon drills, drifters, churn rills, and rotary drills; each is designed to work on a specific size and type of rock. Dynamite and other explosives are used to loosen rock (Peurifoy and Oberlender, 1989).

Once materials have been excavated and removed and the ground cleared and graded, the site is ready for construction.

4.2.2 CONSTRUCTION SITE SIZE CATEGORIES AND ESTIMATES OF AMOUNT OF DISTURBED LAND

The regulatory options evaluated apply to construction sites of all types (i.e., residential, commercial, and industrial) of more than 5 acres of disturbed land. Because the costs of best management practices (BMPs) for erosion and sediment control are largely driven by site size, EPA must estimate the distribution of construction sites by size category, land use type, and geographic region to estimate the total cost of the options. In addition, estimating distribution of sites by type allows EPA to estimate the cost to each construction sector.

The method used to estimate the number of construction sites by size category–and therefore the total area disturbed–is based on a number of data sources, including U.S. Census data and data collected during the Phase II Storm Water rulemaking.

4.2.2.1 National Estimates of Disturbed Acreage

EPA used the U.S. Department of Agriculture's (USDA's) 1997 National Resources Inventory (NRI) to estimate the level of new U.S. development each year. NRI is designed to track changes in land cover and land use over time. The inventory, conducted every five years, covers all non-federal lands in the U.S. (which constitutes 75 percent of the total land area in the U.S.). The program captures land use data from approximately 800,000 statistically selected locations. From 1992 to 1997, an average of 2.2 million acres per year were converted from non-developed to developed status. Table 4-1 shows the allocation of this converted land area by type of land or land cover. Table 4-2 shows the national allocation of developed acres by state.

Table 4-1. Acres Converted from Undeveloped to Developed State, 1992-1997

Type of Land	Acres Converted to Development[a] 1992-1997 (thousands) Annual Average	Percent Contribution by Type of Land
Cropland	574.8	26.6%
Conservation Reserve Program land	1.5	0.1%
Pastureland	391.2	17.4%
Rangeland	245.9	11.0%
Forest land	939.0	41.9%
Other rural area	89.1	4.0%
Water areas and federal land	1.8	0.1%
Total [b]	**2,243.4**	**100.0%**

[a] NRI defines *developed land* as a combination of the following land cover/use categories *large urban and built-up areas*, *small built-up areas*, and *rural transportation land*. These are defined as follows:
Large urban and built-up areas. A land cover/use category composed of developed tracts of at least 10 acres—meeting the definition of urban and built-up areas.
Small built-up areas. A land cover/use category consisting of developed land units of 0.25 to 10 acres, which meet the definition of urban and built-up areas.
Rural transportation land. A land cover/use category which consists of all highways, roads, railroads and associated right-of-ways outside urban and built-up areas; also includes private roads to farmsteads or ranch headquarters, logging roads, and other private roads (field lanes are not included).
Urban and built up areas are in turn defined as:
Urban and built-up areas. A land cover/use category consisting of residential, industrial, commercial, and institutional land; construction sites; public administrative sites; railroad yards; cemeteries; airports; golf courses; sanitary landfills; sewage treatment plants; water control structures and spillways; other land used for such purposes; small parks (less than 10 acres) within urban and built-up areas; and highways, railroads , and other transportation facilities if they are surrounded by urban areas. Also included are tracts of less than 10 acres that do not meet the above definition but are completely surrounded by urban and built-up land. Two size categories are recognized in the NRI: areas of 0.25 acre to 10 acres, and areas of at least 10 acres.
[b] Excludes Alaska
Source: USDA, 2000.

Table 4-2. State Rankings by Rate of Non-Federal Land Developed, 1992 - 1997*

Ranking	State	Average Annual Conversion Rate (acres)	Ranking	State	Average Annual Conversion Rate (acres)
1	Texas	178,700	26	West Virginia	35,360
2	Georgia	170,380	27	Oklahoma	35,340
3	Florida	165,040	28	Arkansas	33,780
4	California	110,680	29	Louisiana	26,720
5	Pennsylvania	109,020	30	Arizona	22,760
6	North Carolina	101,320	31	Colorado	22,500
7	Tennessee	80,380	32	Puerto Rico	22,480
8	Ohio	72,960	33	Maine	22,220
9	Michigan	72,820	34	Oregon	20,780
10	South Carolina	72,400	35	Kansas	19,300
11	Virginia	68,700	36	Idaho	18,380
12	New York	63,520	37	Utah	16,260
13	Alabama	63,060	38	Montana	15,260
14	Illinois	49,300	39	Iowa	13,820
15	Washington	48,160	40	New Hampshire	12,520
16	Kentucky	47,420	41	South Dakota	11,560
17	Minnesota	46,360	42	Nebraska	11,020
18	Missouri	44,840	43	Connecticut	7,880
19	New Mexico	43,440	44	Wyoming	6,880
20	New Jersey	42,720	45	North Dakota	6,560
21	Massachusetts	42,360	46	Nevada	5,340
22	Mississippi	41,280	47	Delaware	4,620
23	Indiana	39,060	48	Vermont	2,300
24	Wisconsin	37,640	49	Hawaii	1,360
25	Maryland	35,520	50	Rhode Island	1,320
* Excludes Alaska					

It is important to note that the 2001 NRI data was becoming available as EPA was finishing its analyses. However, since the national total of acres developed annually (2.2 million acres) was the same for both the 1997 and 2001 NRI datasets, EPA elected not to update its evaluation to reflect the 2001 values.

4.2.2.2 Distribution of Acreage by Project Type

To allocate the NRI acreage among the various segments of the industry, EPA has estimated the distribution of acres developed by type of project in the following way. First, EPA multiplied the number of building permits issued annually by estimates of the average site size for each project type. Thus for single-family residential construction, EPA multiplied the number of new single-family home building permits by the average lot size for new single-family construction. Estimates for other types of construction were based on extrapolations from the U.S. Census permit data and EPA estimates of average project size. Second, EPA adjusted the estimates of acres converted to reconcile any differences between the total number of acres accounted for using this approach and the total acres developed as estimated in the NRI.

Single-family Residential

Census data indicate that in recent years the number of new single-family housing units authorized has averaged just over 1.0 million units per year (see Table 4-3). The average lot size for new single-family housing units is 13,553 square feet, or 0.31 acres (1 acre = 43,560 square feet). Using the average lot size (see Table 4-4), however, will underestimate the total acreage converted for single-family residential projects because it does not include common areas of developments not counted as part of an owner's lot–for example, streets, sidewalks, parking areas, storm water management structures, and open spaces.

Table 4-3. New Single-Family and Multifamily Housing Units Authorized, 1995-1997

Year	All Housing Units	Single-Family Housing Units	Multifamily Housing Units
1995	1,332,549	997,268	335,281
1996	1,425,616	1,069,472	356,144
1997	1,441,136	1,062,396	378,740
1995-1997 avg	**1,399,767**	**1,043,045**	**356,722**

Source: BOC, 2000b. Series C40 New Privately Owned Housing Units Authorized

Table 4-4. Average and Median Lot Size for New Single-Family Housing Units Sold, 1995-1997

Year	Average Lot Size (Square Feet)	Median Lot Size (Square Feet)
1995	13,665	9,375
1996	13,705	9,100
1997	13,290	9,000
1995-1997 avg	**13,553**	**9,158**

Source: BOC, 2000a. Series C25 Characteristics of New Housing

To account for these differences, EPA examined data obtained from a survey of municipalities conducted in support of the Phase II Storm Water rule (EPA 1999). This survey identified 14 communities that consistently collected project type and size data as part of their construction permitting programs.[2] EPA's review of permitting data from these communities covered 855 single-family developments encompassing 18,134 housing units. The combined area of these developments was 11,460 acres. This means that each housing unit accounted for 0.63 acres (11,460 acres ÷ 18,134 units = 0.63 acres per unit). This estimate, essentially double the average lot size, appears to more than account for the common areas and undeveloped areas in a typical single-family residential development. For this reason, EPA averaged the Census estimate of the national average lot size (0.31 acres) and the Phase II estimate of 0.63 acres per unit to arrive at an estimate of 0.47 acres per unit. This number was multiplied by the average number of single-family housing units authorized by building permit, 1.04 million, to arrive at an estimate of 490,231 acres (see Table 4-7).

Multifamily Residential

For residential construction other than single-family housing, EPA divided the average number of units authorized during 1995-1997 (356,722, from Table 4-3) by the average number of units per new multifamily building. The average number of units per building was obtained by examining the distribution of units by unit size class in Census data (BOC 2000b). EPA estimated the number of buildings in each size class by dividing the number of units in each class by the average number of units. The total number of units was then divided into the estimated number of buildings to arrive at an average number of 10.8 units across all building size classes.

EPA next examined data on the average site size for multifamily residential developments. The Center for Watershed Protection reports survey results showing that an average building footprint

[2] The communities were: Austin, TX; Baltimore County, MD; Cary, NC; Ft. Collins, CO; Lacey, WA; Loudoun County, VA; New Britain, CT; Olympia, WA; Prince George's County, MD; Raleigh, NC; South Bend, IN; Tallahassee, FL; Tuscon, AZ; and Waukesha, WI.

occupies 15.6 percent of the total site (CWP 2001). EPA assumed that the average-sized multifamily building (10.8 units) would have two floors and that each unit would occupy the national average of 1,095 square feet (NAHB 2002). The total square footage accounted for by living space is thus 11,826 square feet. Multiplying by a factor of 1.2 to account for common areas and other non-living space (utility rooms, hallways, stairways), and dividing by 2 to reflect the assumption of a 2-story structure, EPA obtained a typical building footprint of 7,096 square feet (11,826 x 1.2 ÷ 2 = 7,096). Combining this with the CWP estimate of the building footprint share of total site size (15.6 percent), the average site size was estimated to be 45,487 square feet (7,096 ÷ 0.156 = 45,487), or just over 1 acre (1.04 acres).

EPA compared the average site size obtained using this approach with data from the 14 community survey referenced above under the Phase II Storm Water rule. That study's review of permitting data identified 286 multifamily developments covering a total of 3,476 acres. The average site size, 12.1 acres, is considerably higher than that calculated above. EPA has no indication that the permits reviewed in these communities are for projects of a larger-than- average size. Therefore, for purposes of this analysis, EPA has taken the midpoint of the estimates, 6.5 acres, as the average size of multifamily projects. This number was multiplied by the average number of multifamily housing developments authorized by building permit, 35,672, to arrive at an estimate of 231,868 acres (see Table 4-7).

Nonresidential Construction

EPA lacked current data on the number of nonresidential construction and development projects authorized annually because the Census Bureau ceased to collect data on the number of permits issued for such projects in 1995. EPA used regression analysis to forecast the number of nonresidential building permits issued in 1997, based on the historical relationship between residential and nonresidential construction activity. Using this approach, EPA estimates that a total of 426,024 nonresidential permits were issued in 1997. These represent a variety of project types, including commercial and industrial, institutional, recreational, as well as nonresidential, nonbuilding projects such as parks and road or highway projects.

EPA first combined a number of project types into a larger "commercial" category, which included hotels and motels and retail and office projects, as well as religious, public works, and educational projects.[3] EPA's reasoning for including the latter categories under the commercial category is based on engineering judgment that erosion and sediment control practices would be similar across each project type. The total estimated number of commercial permits in 1997 was 254,566 (59.7 percent of the nonresidential total). (EPA calculated an estimate for the industrial category, which totaled 12,140 permits (2.8 percent), separately.) The residual 159,318 permits (37.4 percent), are nonbuilding, nonresidential projects that include parks, bridges, roads, and highways. EPA accounts for these projects in the steps described below.

[3] The commercial category included: hotels/motels, amusement, religious, parking garages, service stations, hospitals, offices, public works, educational, stores, and other nonresidential buildings.

For the industrial and commercial categories, EPA reviewed the project size data collected from the 14-community Phase II rule survey referenced earlier (EPA, 1999). This study identified 817 commercial sites occupying 5,514 acres and 115 industrial sites occupying 689 acres. The average site sizes are 6.7 and 6.0 acres, respectively.

EPA also reviewed estimates from CWP (2001) on the average percent of commercial and industrial sites taken up by the building footprint. These percentages, 19.1 and 19.6 respectively, were multiplied across the model project site sizes of 0.5, 3, 7.5, 25, 70, and 200 acres to estimate building size on each site, assuming single-story buildings in each case. These estimates are shown in Table 4-5.

Table 4-5. Average Building Square Footage

Project Size (Acres)	Commercial	Industrial
0.5	4,160	4,269
3	24,960	25,666
7.5	62,400	64,164
25	207,999	213,880
70	582,397	598,863
200	1,663,992	1,711,037

Estimates were obtained by multiplying the site size in square feet by the percentage of the site estimated to be occupied by the building footprint, based on data from CWP (2001).

As seen in the table, the average building size corresponding to the 6- to 7- acre sites estimated from the 14-community study are in the 60,000 square feet range. EPA next examined R.S. Means' *Building Construction Cost Data* (2000), which provides cost data for "typical" commercial and industrial buildings. As part of the cost data, R.S. Means identifies the typical range of building sizes based on a database of actual projects. Table 4-6 shows the typical size and size range for a variety of building types that would fall into either the commercial or industrial category. While some of the building types correspond with the estimated average of 60,000 square feet, these appear high for other categories, such as low-rise office and supermarkets, warehouses, and elementary schools. EPA believes generally that there are more small projects than large ones. As a result, EPA inferred that this approach would suggest an average building size of 25,000 square feet, which implies an average site size of 3 acres, based on Table 4-5.

To reconcile the estimates obtained from the two approaches, EPA has taken the midpoint of the estimates. For commercial development, EPA assumes an average site size of 4.85 acres (the average of 6.7 and 3.0 acres) and for industrial development EPA assumes an average site size of 4.5 acres (the average of 6.0 and 3.0 acres).

Table 4-6. Typical Building Sizes and Size Ranges by Type of Building

Building Category/Type	Typical Size (Gross Square Feet)	Typical Range (Gross Square Feet)	
		Low	High
Commercial - Supermarkets	20,000	12,000	30,000
Commercial - Department Store	90,000	44,000	122,000
Commercial - Low-Rise Office	8,600	4,700	19,000
Commercial - Mid-Rise Office	52,000	31,300	83,100
Commercial - Elementary[a]	41,000	24,500	55,000
Industrial - Warehouse	25,000	8,000	72,000

[a] For the purpose of this analysis EPA combined a number of building types, including educational, under the commercial category.
Source: R.S. Means, 2000.

The resulting average project sizes were then multiplied by the estimated number of commercial and industrial permits to obtain an estimate of the total acreage developed for these project categories. Table 4-7 shows the results of this "bottom-up" approach to estimating the number of acres of land developed. The overall estimate of the amount of land developed is 2.01 million acres per year. Residential single-family development accounts for 24.4 percent of the total, multifamily development for 11.5 percent, commercial for 61.4 percent, and industrial for 2.7 percent.

Table 4-7. National Estimates of Land Area Developed Per Year, Based on Building Permit Data

Type of Construction		Permits: Number	Permits: Pct. of Total	Average Site Size[a]	Acres Disturbed: Number	Acres Disturbed: Pct. of total
Residential	Single-family	1,043,045	77.5%	0.47	490,231	24.4%
	Multifamily	35,672	2.7%	6.5	231,868	11.5%
Nonresidential	Commercial[b]	254,566	18.9%	4.9	1,234,645	61.4%
	Industrial	12,140	0.9%	4.5	54,630	2.7%
Total		**1,345,423**	**100.0%**	**--**	**2,011,374**	**100.0%**

[a] For single-family residential, this is the average of the average lot size for new construction in 1999 (BOC, 2000b) and the average obtained in EPA (1999). For all other categories, the site sizes are EPA assumptions based on representative project profiles contained in R.S. Means (2000) and the 14-community survey conducted in support of the Phase II NPDES storm water rule (EPA, 1999).
[b] A number of project types were grouped together to form the "commercial" category, including: hotels/motels, amusement, religious, parking garages, service stations, hospitals, offices, public works, educational, stores, other nonresidential buildings.

This estimate of 2.01 million acres of annual developed land (Table 4-7) is close to the estimate of 2.2 million acres obtained from NRI. For the purpose of developing national compliance costs of the options and calculating loadings reductions, EPA has allocated the entire NRI developed acreage (excluding Puerto Rico and Hawaii) into the four land use categories according to the percentages shown in the final column of Table 4-7. This revised estimate is shown in Table 4-8.

Table 4-8. National Estimates of Land Area Developed Per Year, Based on National Resources Inventory Totals

Type of Construction		Developed Area Based on Permits Data		Developed Acres Based on NRI Data [b]
		Acres[a]	Pct. of Total	
Residential	Single-family	490,231	24.4%	540,800
	Multifamily	231,868	11.5%	253,358
Nonresidential	Commercial [c]	1,234,645	61.4%	1,366,387
	Industrial	54,630	2.7%	59,009
Total		**2,011,374**	**100.0%**	**2,219,553**

[a] From Table 4-7.
[b] This column distributes the total acreage estimated in NRI to be converted on an annual basis according to the distribution by type of development estimated through analysis of permits data. See also Tables 4-2 through 4-6.
[c] A number of project types were grouped together to form the "commercial" category, including: hotels/motels, amusement, religious, parking garages, service stations, hospitals, offices, public works, educational, stores, other nonresidential buildings.

4.2.2.3 Distribution of Developed Acreage by Project Size

For each of the four land use categories in Table 4-8, EPA developed procedures to allocate developed acre estimates into six site size categories: 0.5, 3, 7.5, 25, 70 and 200 acres. EPA evaluated the survey data collected from 14 municipalities in support of the Phase II storm water rule. This survey identified 14 communities that consistently collect project type and size data as part of their construction permitting programs. From this data set, EPA was able to determine the percentage of projects and developed acreage for each of the six site size groups and four land use categories. Table 4-9 shows the distribution of the 14 community survey data by project size for each of the four land use categories (single family residential, multi-family residential, commercial and industrial). The percentages shown in the "Percent Acres by Size" column of Table 4-9 for each land use type were used to assign total estimated developed acres to site sizes for each of the four land use categories, based on the total developed NRI acreage by category shown in the last column of Table 4-8. The result of this allocation is shown in Table 4-10. The totals differ slightly as fractional sites were rounded to whole numbers. EPA further subdivided developed acreage to a state-level based on the state-specific developed acreage estimates contained in the NRI data and shown in Table 4-2. This distribution to a state-level was necessary for the costing analysis, since costs were calculated on a state-level basis to account for the existing state programs in place. Sites were further subdivided to a watershed level (based in Hydrologic Unit Codes, or "HUCs) for the loadings analysis. At both of these steps, fractional sites were again rounded to whole numbers. As a result, the state and HUC totals of sites and developed acreage do not sum to the national totals. However, the variation is minor.

Table 4-9. Distribution of 14 Community Survey Permits by Site Size

Site Size (Acres)	No. of Permits	Acres by Size	Pct. Acres by Size	Site Size (Acres)	No. of Permits	Acres by Size	Pct. Acres by Size
Single-Family Residential				***Commercial***			
0.5	266	133	1.2%	0.5	266	133	2.5%
3	228	684	6.0%	3	356	1,068	19.8%
7.5	138	1,035	9.1%	7.5	86	645	12.0%
25	175	4,375	38.6%	25	91	2,275	42.3%
70	30	2,100	18.5%	70	16	1,260	23.4%
200	15	3,000	26.5%	200	0	0	0.0%
Total	852	11,327	100.0%	Total	815	5,381	100.0%
Multifamily Residential				***Industrial***			
0.5	43	22	0.6%	0.5	39	20	2.9%
3	100	300	8.7%	3	55	165	24.6%
7.5	61	458	13.3%	7.5	10	75	11.2%
25	71	1,775	51.4%	25	8	200	29.9%
70	10	700	20.3%	70	3	210	31.4%
200	1	200	5.8%	200	0	0	0.0%
Total	286	3,455	100.0%	Total	115	670	100.0%
Total							
0.5	614	307	1.5%				
3	739	2,217	10.6%				
7.5	295	2,213	10.6%				
25	345	8,625	41.4%				
70	59	4,270	20.5%				
200	16	3,200	15.4%				
Total	2,068	20,832	100.0%				

Based on permitting data from the following municipalities or counties: Austin, TX; Baltimore County, MD; Cary, NC; Ft. Collins, CO; Lacey, WA; Loudoun County, VA; New Britain, CT; Olympia, WA; Prince George's County, MD; Raleigh, NC; South Bend, IN; Tallahassee, FL; Tuscon, AZ; and Waukesha, WI.
Assumes sites less than 1 acre are represented by an average of 0.5 acres.
Source: USEPA, 1999

Table 4-10. Distribution of National Construction by Site Size and Development Type

Site Size (Acres)	No. of Permits	Acres by Size	Pct. Acres by Size	Site Size (Acres)	No. of Permits	Acres by Size	Pct. Acres by Size
Single-Family Residential				***Commercial***			
0.5	12,753	6,377	1.2%	0.5	67,590	33,795	2.5%
3	10,932	32,796	6.1%	3	90,458	271,374	19.9%
7.5	6,611	49,582	9.2%	7.5	21,845	163,838	12.0%
25	8,387	209,675	38.8%	25	23,116	577,900	42.3%
70	1,431	100,170	18.5%	70	4,564	319,480	23.4%
200	711	142,200	26.3%	200	0	0	0.0%
Total	40,825	540,800	100.0%	Total	207,573	1,366,387	100.0%
Multifamily Residential				***Industrial***			
0.5	3,178	1,589	0.6%	0.5	3,491	1,746	3.0%
3	7,408	22,224	8.8%	3	4,931	14,793	25.1%
7.5	4,514	33,855	13.4%	7.5	888	6,660	11.3%
25	5,258	131,450	51.9%	25	710	17,750	30.1%
70	732	51,240	20.2%	70	258	18,060	30.6%
200	65	13,000	5.1%	200	0	0	0.0%
Total	21,155	253,358	100.0%	Total	10,278	59,009	100.0%
Total							
0.5	87,012	43,507	2.0%				
3	113,729	341,187	15.4%				
7.5	33,858	253,935	11.4%				
25	37,471	936,775	42.2%				
70	6,985	488,950	22.0%				
200	776	155,200	7.0%				
Total	279,831	2,219,554	100.0%				

Based on permitting data from the following municipalities or counties: Austin, TX; Baltimore County, MD; Cary, NC; Ft. Collins, CO; Lacey, WA; Loudoun County, VA; New Britain, CT; Olympia, WA; Prince George's County, MD; Raleigh, NC; South Bend, IN; Tallahassee, FL; Tuscon, AZ; and Waukesha, WI.
Assumes sites less than 1 acre are represented by an average of 0.5 acres.
Source: USEPA, 1999

4.2.2.4 State-Level Estimation of Developed Acreage and Sites

Based on the state-level estimates of the amount of construction acreage occurring annually, the number of national construction sites by land use in Table 4-9 was distributed to the state level. Table E-1 in Appendix E indicates the number of construction sites by site size and land use for each state.

4.2.2.5 Estimates of Number of Sites and Acreage Covered by Regulatory Options

Based on the information in Table 4-9 and 4-10, EPA was able to estimate the amount of acreage covered under the various regulatory options considered. This information is illustrated in Table 4-11. It is important to note, however, that these estimates include all national construction acreage occurring annually in the U.S. The actual number of sites that would be required to implement controls in response to the Option 4 is actually much lower than for Options 1 and 2, since in many states the existing requirements are equivalent to or more stringent than the requirements contained in this option. For Options 1 and 2, however, since no states currently have equivalent inspection and certification requirements the number of sites and acreage incurring costs are the same as the entire universe of sites that would have been subject to the guidelines under these options. Table 4-12 contains EPA's estimates of the number of sites and acreage that are actually expected to incur costs as a result of the regulatory options considered. This table integrates the results of the state equivalency analysis presented in Section 7 with the state-level estimates of construction sites by site size and land use presented in Table E-1 in Appendix E.

Table 4-11. National Construction Acreage Subject to Effluent Guidelines Requirements

Type of Construction	Option 1		Options 2 and 4	
	Acres	Number of Construction Sites	Acres	Number of Construction Sites
Single-family Residential	534,424	28,072	501,628	17,140
Multi-family Residential	251,769	17,977	229,545	10,569
Commercial	1,332,592	139,983	1,061,218	49,525
Industrial	57,263	6,787	42,470	1,856
Total	2,176,047	192,819	1,834,860	79,090
Percent of National Total	98.0 %	68.9 %	82.7 %	28.3 %

Table 4-12. Acreage Incurring Costs Under Options Considered

Type of Construction	Option 1		Option 2		Option 4	
	Acres	Number of Sites	Acres	Number of Sites	Acres	Number of Sites
Single-family Residential	534,424	28,072	501,628	17,140	324,478	11,087
Multi-family Residential	251,769	17,977	229,545	10,569	148,481	6,837
Commercial	1,332,592	139,983	1,061,218	49,525	686,450	32,035
Industrial	57,263	6,787	42,470	1,856	27,472	1,201
Total	2,176,047	192,819	1,834,860	79,090	1,186,881	51,159
Percent of National Total	98.0 %	68.9 %	82.7 %	28.3 %	53.5 %	18.3%

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